

CHAPTER 4

81-mm MORTAR, M252

The 81-mm mortar, M252, delivers timely, accurate fires to meet the requirements of supported troops. This chapter discusses assigned personnel duties, crew drill, mechanical training, and characteristics of the mortar.

Section I. SQUAD AND SECTION ORGANIZATION AND DUTIES

Each member of the infantry mortar squad has principle duties and responsibilities. (See FM 7-90 for a discussion of the duties of the platoon headquarters.)

4-1. ORGANIZATION

If the mortar section is to operate quickly and effectively in accomplishing its mission, mortar squad members must be proficient in individually assigned duties. Correctly applying and performing these duties enables the mortar section to perform as an effective fighting team. The platoon leader commands the platoon and supervises the training of the elements. He uses the chain of command to assist him in effecting his command and supervising duties.

4-2. DUTIES

The mortar squad consists of five men (Figure 4-1, page 4-2). Their firing positions and principal duties are as follows:

- a. The *squad leader* stands behind the mortar where he can command and control his squad. In addition to supervising the emplacement, laying, and firing of the mortar, he supervises all other squad activities.
- b. The *gunner* stands to the left side of the mortar where he can manipulate the sight, elevating handwheel, and traversing handwheel. He places firing data on the sight and lays the mortar for deflection and elevation. He makes large deflection shifts by shifting the bipod assembly and keeps the bubbles level during firing.
- c. The *assistant gunner* stands to the right of the mortar, facing the barrel and ready to load. In addition to loading, he swabs the bore after 10 rounds have been fired or after each fire mission. He may assist the gunner in shifting the mortar when the gunner is making large deflection changes.
- d. The *first ammunition bearer* stands to the right rear of the mortar. He has the duty of preparing the ammunition and passing it to the assistant gunner. He is also the squad driver.
- e. The *second ammunition bearer* stands to the right rear of the mortar behind the ammunition bearer. He maintains the ammunition for firing and provides local security for the mortar position. He performs other duties as the squad leader directs.

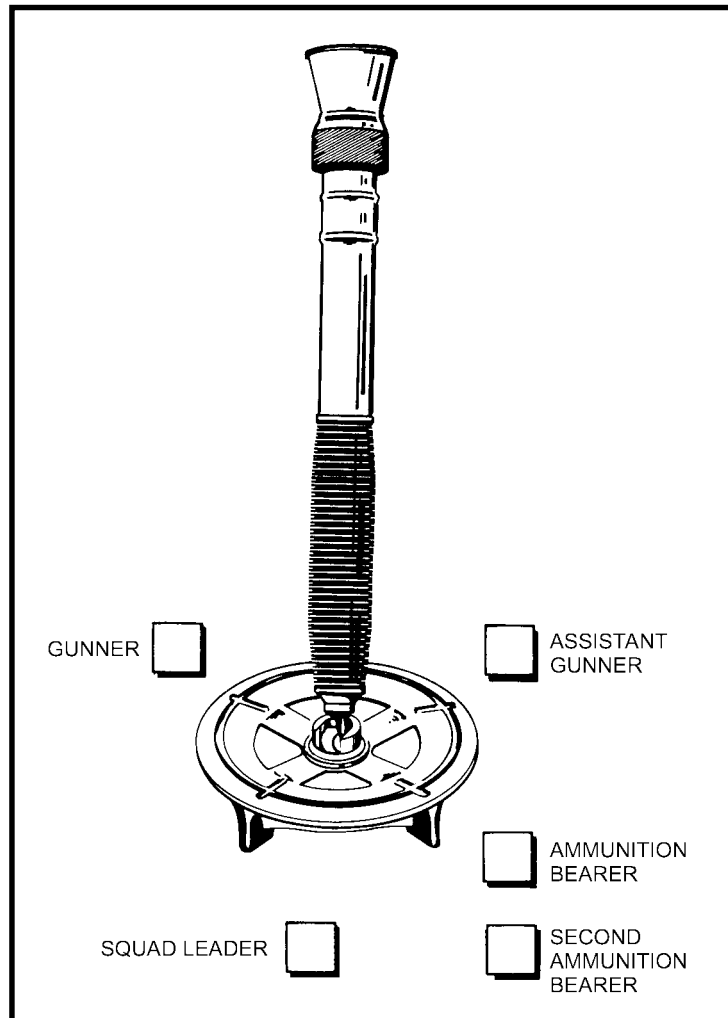


Figure 4-1. Position of squad members.

Section II. COMPONENTS

The 81-mm mortar, M252, is a smooth-bore, muzzle-loaded, high-angle-of-fire weapon. The components of the mortar consist of a cannon, mount, and baseplate. This section discusses the characteristics and nomenclature of each component (Figure 4-2).

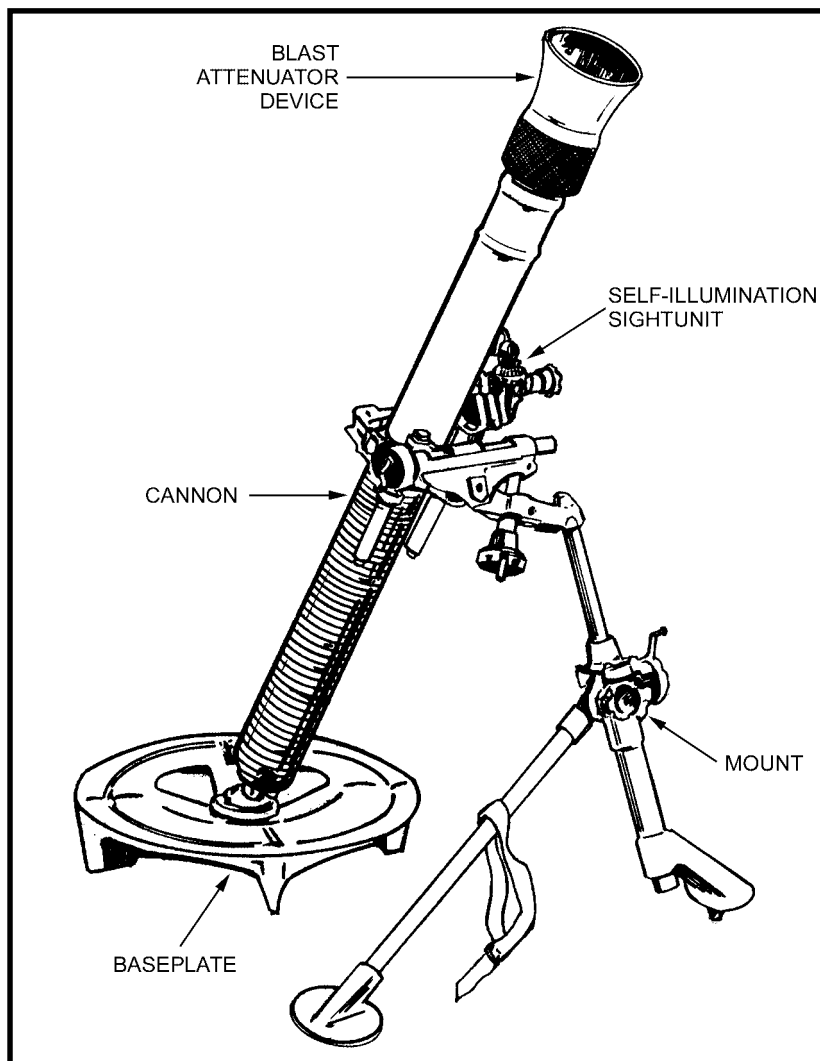


Figure 4-2. The 81-mm mortar, M252.

4-3. TABULATED DATA

The tabulated data of the 81-mm mortar, M252, are shown in Table 4-1.

Weights (pounds)				
System (including basic issue items)				121
Barrel (with blast attenuator device)				35
Mount				27
M3A1 Baseplate				29
M64A1 Sightunit				2.5
Ammunition	<u>HE</u>	<u>Smoke</u>	<u>Illum</u>	<u>Practice</u>
Ready to fire	9.4	10.6	9.1	9.4
In single container	12.0	13.8	12.4	12.5
In three-round pack	57.0	63.0	60.0	60.0
Elevation				
Elevation (approximate)				800 to 1515 mils
For each turn of elevation drum (approximate)				10 mils
Traverse				
Right or left from center (approximate)				100 mils (10 turns)
Range				
Minimum to maximum				83 to 5,608 meters
Rate of Fire				
Sustained				15 rounds per minute indefinitely
Maximum				30 rounds per minute for 2 minutes
HE Lethality				
(M821/M889)				30 percent greater than current US M374 series
Smoke Screen (M819)				
(maximum range 4,875 meters)				90 to 150 by 30 to 40 meters for 2 2 to 3 minutes
Illumination (M853A1)				
(maximum range 5,050 meters)				600,000 candlepower for 1 minute
HE Fuze Options				
				M821 w/multioption fuze M734
				M889 w/point-detonating fuze M935
Sight				
				M64A1, lightweight, self-Illuminating

Table 4-1. Tabulated data.

4-4. CANNON ASSEMBLY, M253

The cannon assembly consists of the barrel that is sealed at the lower end with a removable breech plug, which houses a removable firing pin (Figure 4-3). At the muzzle end is a cone-shaped blast attenuator device (BAD) that is fitted to reduce noise. The BAD is removed only by qualified maintenance personnel.

Note: The terms cannon and barrel are used interchangeably in this chapter.

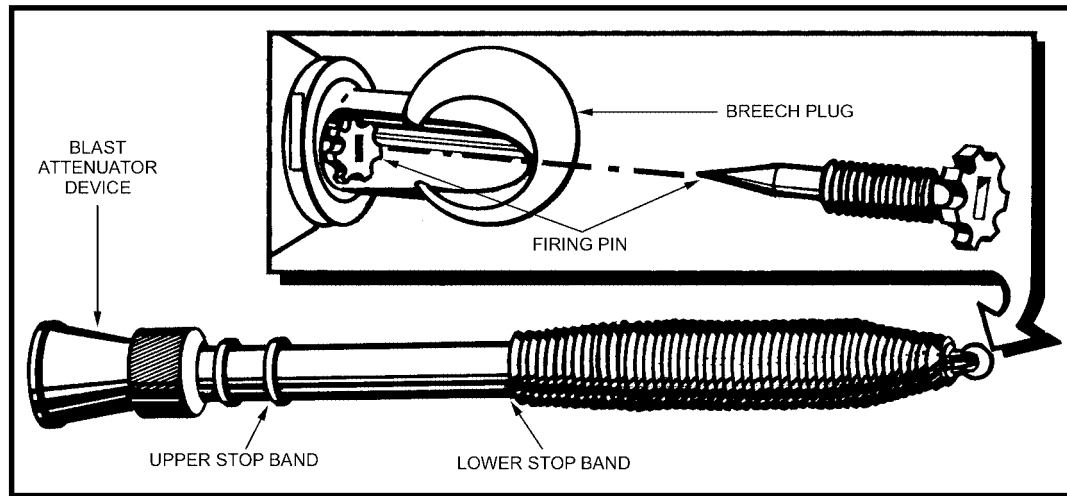


Figure 4-3. Cannon assembly, M253.

4-5. MOUNT, M177

The mount consists of elevating and traversing mechanisms and a bipod (Figure 4-4).

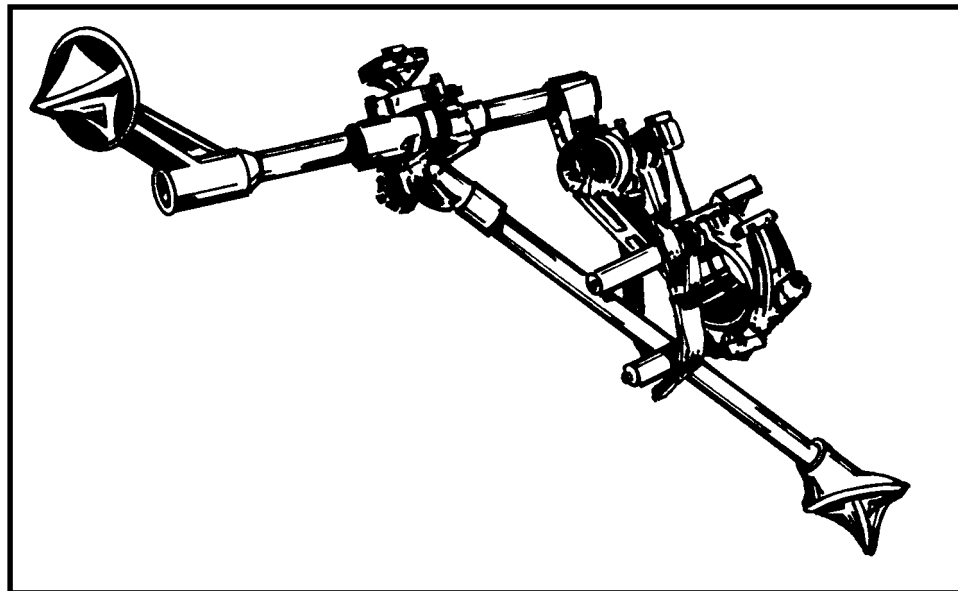


Figure 4-4. Mount, M177, in folded position.

a. The bipod provides front support for the barrel and carries the gears necessary to lay the mortar. The barrel clamp, which consists of an upper and lower clamp, is situated at the top. The upper clamp is fitted with a locking arrangement that consists of a curved handle and a spring-loaded locking rod, which is ball-shaped at its lower end. The lower clamp is shaped and bored on each side to house the buffer cylinders. On its right side, the clamp is recessed to receive the ball end of the locking rod. A safety latch located at the side of the recess is used to secure the ball.

b. The sight bracket is attached to the buffer carrier, which is fitted to the traversing screw assembly. Attached to the right of the screw is the traversing handwheel. The traversing screw assembly is fitted to the clamp assembly, which is pivoted in the center on an arm attached to the elevating leg. Attached to the arm is the cross-leveling mechanism, which is attached to the clamp assembly at its upper end.

c. The elevating shaft is contained in the elevating leg; to the left of the elevating leg is the elevating handwheel. A plain leg is fitted to a stud on the elevating leg and is secured by a leg-locking handwheel. A spring-loaded locating catch is behind the elevating gear housing, which locates the plain leg in its supporting position for level ground. A securing strap is attached to the plain leg for securing the bipod in the folded position. Both legs are fitted with a disk-shaped foot with a spike beneath to prevent the mount from slipping.

4-6. BASEPLATE, M3A1

The baseplate (Figure 4-5) is of one-piece construction, and supports and aligns the mortar for firing. During firing, the breech plug on the barrel is sealed and locked to the rotatable socket in the baseplate.

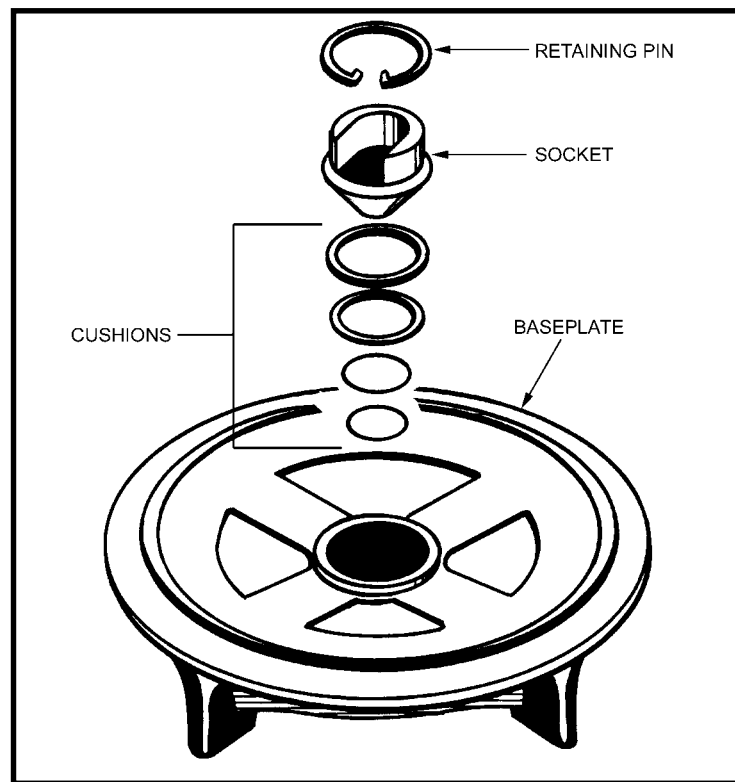


Figure 4-5. Baseplate, M3A1.

Section III. OPERATION

This section contains information on how to prepare the 81-mm mortar, M252, for firing, how to conduct safety checks, and, if a misfire should occur during firing, what actions the crew applies to remove the cartridge from the barrel.

4-7. PREMOUNT CHECKS

Before the mortar is mounted, the squad must perform premount checks. Each squad member should be able to perform all the following premount checks:

- a. The gunner checks the baseplate and ensures that—
 - (1) The rotating socket is free to move in a complete circle.
 - (2) The ribs and braces have no breaks, cracks, or dents.
 - (3) The circlip is correctly located, securing the rotating socket to the baseplate.
- b. The assistant gunner checks the bipod and ensures that—
 - (1) The barrel clamps are clean and dry.
 - (2) The barrel carrier is centered.
 - (3) The securing strap is correctly located, securing the barrel clamps and buffers to the plain leg.
 - (4) The leg-locking handwheel is hand tight.
 - (5) Four inches of elevation shaft are exposed, and the shaft is not bent.
- c. The first ammunition bearer checks the barrel and ensures that—
 - (1) The barrel is clean and free from grease and oil both inside and out.
 - (2) The breech plug is screwed tightly to the barrel.
 - (3) The firing pin is secured correctly.
 - (4) The blast attenuator device is secured correctly.
- d. The squad leader supervises the squad drill and is responsible for supervising the laying out of the equipment as shown in Figure 4-6, page 4-8. The equipment is placed out the same as for the gunner's examination (Chapter 9).

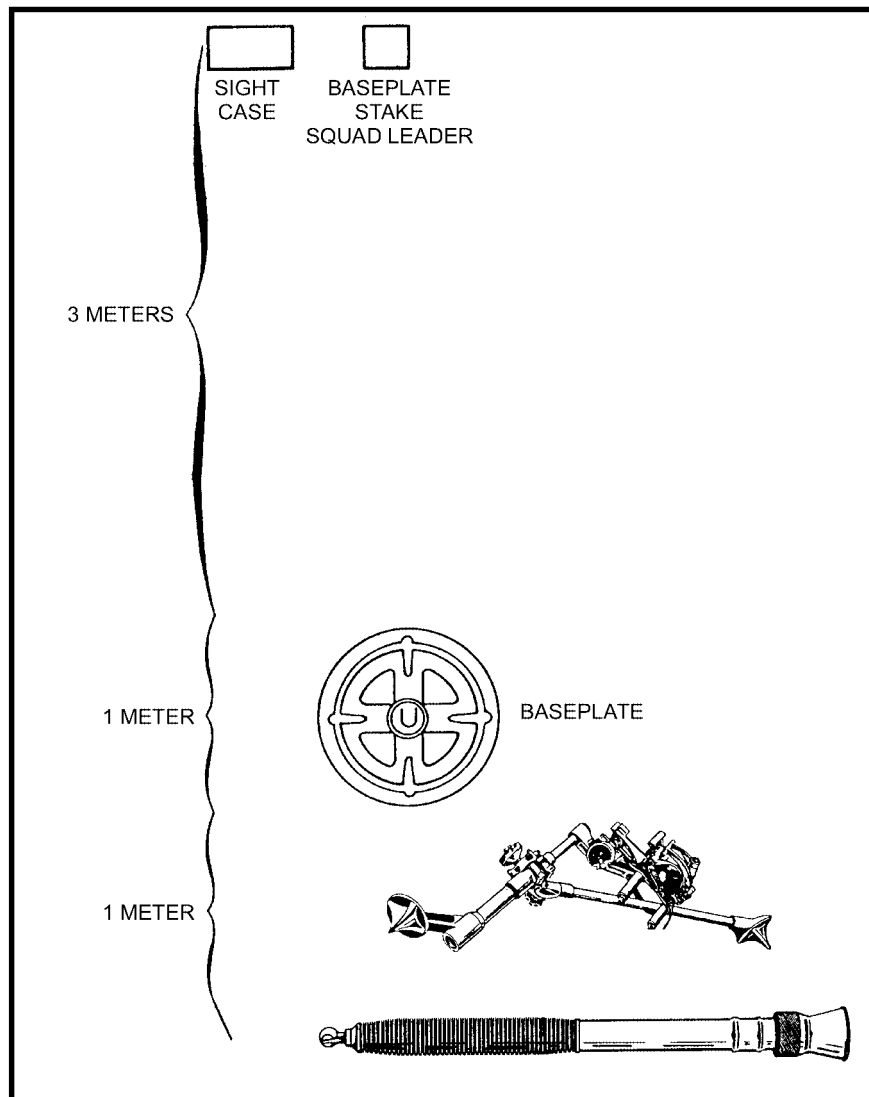


Figure 4-6. Layout of equipment.

4-8. MOUNTING OF THE MORTAR

The squad leader picks up the sight case and the two aiming posts, and moves to the exact position where the mortar is to be mounted. He places the sight case and aiming posts to the left front of the mortar position. The squad leader points to the exact spot where the mortar is to be mounted. He indicates the initial direction of fire by pointing in that direction and commands ACTION.

a. The gunner places the outer edge of the baseplate against the baseplate stake so that the left edge of the cutaway portion of the baseplate is aligned with the right edge of the stake (Figure 4-7). He rotates the socket so that the open end is pointing in the direction of fire. During training, the gunner may use the driving stake from the aiming post case.

Note: The squad leader indicates the direction of fire when mounting.

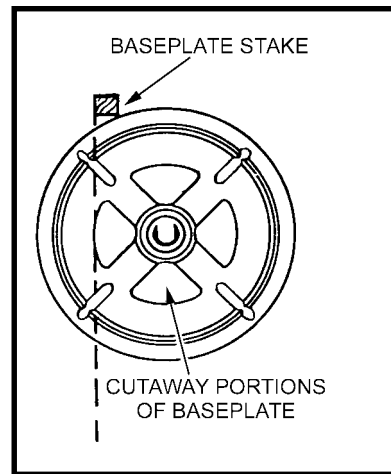


Figure 4-7. Baseplate placed against baseplate stake.

b. When the baseplate is in position, the first ammunition bearer lowers the breech plug into the rotating socket and rotates the barrel a quarter of a turn to lock it. He ensures that the firing pin recess is facing upwards. He stands to the rear of the baseplate and supports the barrel until the bipod is fitted.

c. The assistant gunner lifts the bipod and stands it on its elevating leg so that the elevating handwheel is to the rear and the plain leg is to the front. He releases the securing strap, loosens the leg-locking handwheel, and lowers the plain leg until the locating catch engages in the recess. The leg-locking handwheel must then be tightened by hand, ensuring the teeth on either side are correctly meshed. The assistant gunner exposes 8 inches (200 millimeters) of elevation shaft, leaving the elevation handwheel unfolded. He opens the cross-level handwheel, traversing handwheel, and barrel clamp. The assistant gunner carries the bipod to the front of the barrel and places the bipod feet on the ground 12 to 15 inches in front of the baseplate and astride the line of fire. He positions the lower barrel clamp against the lower stop band on the barrel and secures the upper barrel clamp. He must ensure that the ball-shaped end of the locking rod is secured in its recess by the locking latch.

d. The gunner removes the sight from its case, mounts it on the mortar, and sets a deflection of 3200 mils and an elevation of 1100 mils. He levels all bubbles.

4-9. SAFETY CHECKS BEFORE FIRING

The following safety checks must be enforced before firing the mortar.

a. The gunner ensures that—

(1) Mask clearance and overhead clearance are sufficient.

(a) Since the mortar is normally mounted in defilade, there could be a mask such as a hill, tree, building, or rise in the ground. Overhead interference can be branches of trees or roofs of buildings. In any case, the gunner must ensure that the cartridge does not strike an obstacle.

(b) In selecting the exact mortar position, the leader looks quickly for mask clearance and overhead interference. After the mortar is mounted, the gunner makes a thorough check.

(c) The gunner determines mask and overhead clearance by sighting along the barrel with his eye near the breech plug. If the line of sight clears the mask, it is safe to fire. If not, he may still fire at the desired range by selecting a charge zone having a higher elevation. When firing under the control of an FDC, he reports to the FDC that mask clearance cannot be obtained at a certain elevation.

(d) Firing is slowed if mask clearance must be checked before each firing but this can be eliminated if minimum mask clearance is determined. This is accomplished by depressing the barrel until the top of the mask is clear. The gunner levels the elevation bubble by turning the elevation micrometer knob and reading the setting on the elevation scale and elevation micrometer—this setting is the minimum mask clearance. The squad leader notifies the FDC of the minimum mask clearance elevation. Any target that requires that elevation, or a lower one, cannot be engaged from that position.

(e) If the mask is not regular throughout the sector of fire, the gunner determines the minimum mask clearance as described above. Placing the mortar in position at night does not relieve the gunner of the responsibility of checking for mask clearance and overhead interference.

(2) The barrel is locked to the baseplate, and the open end of the socket points in the direction of fire.

(3) The firing pin recess faces upwards.

(4) The bipod locking latch is locked, securing the barrel clamps.

Note: See TM 9-1015-200-10 for more on loading and firing.

(5) The leg-locking handwheel is tight.

b. The assistant gunner cleans the bore and swabs it dry.

c. The first ammunition bearer ensures that each cartridge is clean, the safety pin is present, and the ignition cartridge is in good condition.

4-10. SMALL DEFLECTION AND ELEVATION CHANGES

With the mortar mounted and the sight installed, the gunner lays the sight on the two aiming posts (placed out 50 and 100 meters from the mortar) on a referred deflection of 2800 mils and an elevation of 1100 mils. The mortar is within two turns of center of traverse. The vertical cross line of the sight is on the left edge of the aiming point.

a. The gunner is given a deflection change in a fire command between 20 and 60 mils inclusive. The elevation change announced must be less than 90 mils and more than 35 mils.

b. As soon as the sight data are announced, the gunner places it on the sight, lays the mortar for elevation, and traverses onto the aiming post by turning the traversing handwheel and adjusting nut in the same direction. One-quarter turn on the adjusting nut equals one turn of the traversing handwheel. When the gunner is satisfied with his sight picture he announces, “Up.”

Note: All elements given in the fire command are repeated by the squad.

c. After the gunner has announced, “Up,” the squad leader should check the mortar to determine if the exercise was performed correctly.

4-11. LARGE DEFLECTION AND ELEVATION CHANGES

With the mortar mounted and the sight installed, the gunner lays the sight on the two aiming posts (placed out 50 and 100 meters from the mortar) on a referred deflection of 2800 mils and an elevation of 1100 mils.

a. The gunner is given a deflection and elevation change in a fire command causing the gunner to shift the mortar between 200 and 300 mils for deflection and between 100 and 200 for elevation.

b. As soon as the sight data are announced, the gunner places it on the sight. The gunner should expose 6 inches (150 millimeters) of elevation shaft and center the buffer carrier. This ensures a maximum traversing and elevating capability after making the movement.

c. The assistant gunner moves into position to the front of the bipod on his right knee and grasps the bipod legs (palms up), lifting until they clear the ground enough to permit lateral movement. The gunner moves the mortar as the assistant gunner steadies it. The assistant gunner attempts to maintain the traversing mechanism on a horizontal plane. To make the shift, the gunner places the fingers of his right hand in the muzzle and his left hand on the left leg. He moves the mortar until the vertical line of the sight is aligned approximately on the aiming post. When the approximate alignment is completed, the gunner signals the assistant gunner to lower the bipod by pushing down on the mortar.

d. The gunner rough levels the cross-level bubble by making the bubble bounce from one side to the other. He then checks the sight picture to ensure he is within 20 mils of a proper sight picture. If he is not within 20 mils, the gunner and assistant gunner must make another large shift before moving on.

e. The gunner centers the elevation bubble. He lays for deflection, taking the proper sight picture. The mortar should be within two turns of center of traverse when the task is complete.

f. The open end of the socket must continue to point in the direction of fire. Normally, it can be moved by hand, although this may be difficult to do if the mortar is moved through a large arc. If required, the gunner/assistant gunner lowers the barrel so that the breech plug engages with the open end of the socket, and he uses the barrel as a lever to move the socket.

g. The barrel clamps can be moved along the barrel to counter large changes in elevation. This may preclude moving the bipod. It is especially useful if the baseplate sinks deep into the ground during prolonged firing. Upon completion of any bipod movement on the barrel, the gunner ensures that the firing pin recess is facing upward.

h. Where the ground is uneven and there is no level surface for the bipod, the gunner can adjust the plain leg. While the assistant gunner supports the barrel, the gunner slackens the leg-locking handwheel, releases the locating catch, and positions the plain leg. The leg-locking handwheel must then be tightened, ensuring the teeth are correctly meshed.

4-12. REFERRING OF THE SIGHT AND REALIGNMENT OF AIMING POSTS USING M64 SIGHT

Referring and realigning aiming posts ensure that all mortars are set on the same data. The section leader, acting as FDC, has one deflection instead of two or more.

a. The mortar is mounted and the sight is installed. The sight is laid on two aiming posts (placed out 50 and 100 meters from the mortar) on a referred deflection of 2800 mils and an

elevation of 1100 mils. The mortar is within two turns of center of traverse. The gunner is given an administrative command to lay the mortar on a deflection of 2860 or 2740 mils. The mortar is then re-laid on the aiming posts using the traversing crank.

b. The gunner is given a deflection change between 5 and 25 mils, either increasing or decreasing from the last stated deflection, and the command to refer and realign aiming posts.

EXAMPLE

REFER DEFLECTION TWO EIGHT SEVEN FIVE (2875), REALIGN AIMING POSTS.

c. Upon receiving the command REFER, REALIGN AIMING POST, two actions take place at the same time in the mortar squad. The gunner places the announced deflection on the sight (without disturbing the lay of the weapon) and looks through the sight unit. At the same time, the first ammunition bearer moves out on the double to realign the aiming posts. He knocks down the near aiming post and proceeds to the far aiming post. Following the arm-and-hand signals of the gunner (who is looking through the sight unit), he moves the far aiming post so that the gunner obtains an aligned sight picture. The same procedure for aligning the far aiming post is used to align the near aiming post.

4-13. MALFUNCTIONS

See Chapter 3, paragraph 3-14 for a detailed discussion of malfunctions.

4-14. REMOVAL OF A MISFIRE

When a misfire occurs, any member of the squad immediately announces, "Misfire." The entire squad stays with the mortar. The gunner then kicks the barrel several times with his heel in an attempt to dislodge the round. If the round fires, the mortar is re-laid on the aiming point and firing is continued.

WARNING

During peacetime live-fire training, all personnel, except the gunner, move 50 meters or farther to the rear of the mortar.

a. If the round does not fire, the gunner tests the barrel for heat. If the barrel is cool enough to handle, the crew removes the round as described below. If the barrel is hot, the gunner may then apply water to the outside of the barrel until it is cool. If water is not available, the gunner must stand clear of the mortar until the barrel is cool.

WARNING

During peacetime live-fire training, if the round does not fire, the gunner joins the crew and waits one minute to avoid a possible personal injury due to a cookoff. After waiting one minute, the gunner returns to the mortar and tests the barrel for heat. When the barrel is cool enough to handle, the gunner signals for the rest of the crew to come forward.

b. After the barrel cools, the gunner removes the sight and firing pin. This ensures that the mortar does not fire should the round slip down the barrel during the subsequent drills. The gunner can depress the barrel, if necessary, to provide easier access to the firing pin. The gunner unlocks the barrel clamp and rotates the barrel, unlocking the breech plug from the rotating socket of the baseplate. Then he relocks the barrel clamp.

c. The gunner grasps both ends of the traverse screw assembly and supports the mortar during the subsequent drill. The assistant gunner places his right hand palm up (1 inch from the muzzle end) under the BAD and his left hand palm down (1 inch from the muzzle end) on top. He places his thumbs alongside the forefingers, being careful to keep both hands away from the muzzle. The first ammunition bearer puts both hands on the cooling fins under the barrel and slowly lifts the barrel until it is horizontal. He must not stand directly behind the mortar.

d. When the barrel reaches the horizontal position, and not before, the assistant gunner moves the thumb of each hand over the muzzle. When the fuze of the misfired round reaches the BAD, the assistant gunner stops the round with his thumbs (he does not touch the fuze) and carefully removes it from the barrel. The first ammunition bearer shakes the barrel to dislodge any remnants from the last round fired, and he lowers the barrel into the rotating socket of the baseplate.

e. The assistant gunner passes the round to the first ammunition bearer who inspects it for the cause of the misfire. If the primer of the ignition cartridge is dented, the first ammunition bearer attempts to replace the safety wire and places the round in a marked, safe location for disposal by ordnance personnel. If the primer is not dented, the round may be used again. The firing pin must be replaced and the bore swabbed.

f. If the above procedure fails to remove the misfire, the barrel must be kept horizontal. Then it is removed from the bipod and laid horizontally on the ground at the dud pit until it can be turned over to ordnance personnel.

4-15. DISMOUNTING OF THE MORTAR

To dismount the mortar, the squad leader commands, OUT OF ACTION. At this command, the squad proceeds as follows:

a. The gunner removes the sight and places it in the case with 3200 deflection and 0800 elevation indexed.

b. The first ammunition bearer holds the barrel until the assistant gunner has removed the mount. The barrel is then rotated a quarter turn to unlock it from the socket, and it is

placed in an area designated by the squad leader. The second ammunition bearer retrieves the aiming posts.

c. The assistant gunner disengages the barrel clamps and moves the bipod from the immediate area of the mortar position. The barrel clamps are then closed. With the clamps facing away from him, the assistant gunner traverses the buffer carrier to the traversing handwheel and folds the handle. He exposes 1 inch (25 millimeters) of cross-level shaft and folds the handle. He exposes 4 inches (100 millimeters) of elevation shaft and folds the handle. Finally, the assistant gunner loosens the leg-locking handwheel, presses the spring-loaded locating catch, and raises the plain leg behind the buffer cylinders until it touches the traversing handwheel. He tightens the leg-locking handwheel (ensuring the teeth are correctly meshed) and fastens the securing strap over the arm and around the buffers.

d. The gunner recovers the baseplate to the area designated by the squad leader.

e. The squad leader picks up the aiming posts and sight. At the command, MARCH ORDER, the squad places the mortar, equipment, and ammunition in the squad vehicle and trailer.

Section IV. AMMUNITION

This section implements STANAG 2321 and QSTAG 900 (Edition 1).
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The ammunition that can be fired by the 81-mm mortar, M252, is identified and described herein.

4-16. CLASSIFICATION

Ammunition is typed according to use (Table 4-2). High explosive is used for both fragmentation and blast effect against personnel and light-skinned vehicles. Red phosphorus/white phosphorus is used for screening, producing casualties, creating incendiary effects, and signaling. Illuminating is used for battlefield illumination and signaling. Training practice is used only for training.

Note: Standard A ammunition for the M29A1 mortar is Standard B for the M252 mortar (Table 4-3, page 4-16). Standard B ammunition for the M29A1 mortar is Standard C for the M252 mortar.

a. **Identification.** All mortar cartridges are painted to prevent rust and to identify their type.

(1) *Marking on container.* The contents of ammunition containers are shown by markings. Additional information is included on an ammunition data card inside each container.

(2) *Color code.* All rounds are colored according to their type.

(3) *Markings on rounds.* Each round is stenciled with the ammunition lot number, type of round, type of filler, and caliber.

b. **Ammunition Lot Number.** An ammunition lot number is assigned to each ammunition lot, which is marked on each cartridge and packing container. It is used for records such as reports on condition, malfunctions, and accidents.

c. **Authorized Cartridges.** The following are authorized (Standard B) cartridges for the 81-mm mortar, M252:

- High explosive—M821, M889, M374-series, and M362.
- Red phosphorus/white phosphorus—M819 and M375-series.
- Illuminating—M853 and M301-series.
- Training practice—M879, M880, M68, and sabot.

	CARTRIDGE				
	M821	M889	M819	M853	M880
TYPE	HE	HE	RP	ILLUM	TP
STANDARD	A	A	A	A	A
MINIMUM RANGE (meters)	83	83	300	300	47
MAXIMUM RANGE (meters)	5,608	5,608	4,875	5,100	458
EFFECTIVE BURSTING AREA	40-meter diameter	40-meter diameter		1,200-meter diameter	
AVERAGE BURN TIME (seconds)				60	
FUZE	M734	M935	M772	M772 M768	M775
COLOR CODING	Olive drab w/yellow markings	Olive drab w/yellow markings	Light green Brown band w/black markings	White with black markings	Blue with white markings

Table 4-2. Types of rounds, classification, and characteristics for the 81-mm mortar, M252.

	CARTRIDGE			
	M374A3	M375A2	M301A3	SABOT
TYPE	HE	WP	ILLUM	TP
STANDARD	A		A	NA
MINIMUM RANGE (meters)	73	70	100	70
MAXIMUM RANGE (meters)	4,800	4,595	3,150	435
EFFECTIVE BURSTING AREA	34-meter diameter		1,100-meter diameter	
AVERAGE BURN TIME (seconds)			60	
FUZE	M524 M526 M532	M524 M526 M567	M84	M744 M745 M746 M747
COLOR CODING	Olive drab w/yellow markings	Light green Yellow band with red markings	White with black markings	Silver metal

Table 4-3. Types of rounds, classification, and characteristics for the 81-mm mortar, M29A1 (Standard B for the 81-mm mortar, M252).

4-17. FUNCTION

Each cartridge has fins around the tail to stabilize it in flight and to cause it to strike fuze-end first. The propelling charge consists of an ignition cartridge and removable propellant increments. The ignition cartridge (with primer) is fitted into the base of the fin shaft. The removable increments are fitted onto or around the shaft, depending on their type. The cartridge is dropped down the barrel, fin-end first. The ignition cartridge strikes the firing pin and detonates, which causes a flash that passes through the radial holes in the shaft. The propellant increments are ignited, which produce rapidly expanding gases that force the cartridge from the barrel. The obturating ring ensures equal muzzle velocities in hot or cold barrels by keeping all the gases in the barrel until the cartridge has fired. When fired, the cartridge carries the ignition cartridge with it, leaving the mortar ready for the next cartridge.

4-18. HIGH-EXPLOSIVE AMMUNITION

Several types of HE ammunition are used in the 81-mm mortar, M252. HE ammunition is used against personnel and materiel.

a. The M821 HE cartridge (M252 only) is a British-made cartridge fitted with the US M734 multioption fuze. It is constructed from ductile cast iron and contains about 1.5 pounds of cyclonite (RDX)/trinitrotoluene (TNT) composition explosive. The aluminum tail

assembly has six integral fins equally spaced around the rear, which stabilize the round in flight. The cartridge is painted olive drab with yellow markings. Each cartridge weighs about 10 pounds and is provided with the M223 propelling charge, consisting of four horseshoe-shaped increments fitted around the tail.

b. The M889 HE cartridge (M252 onlyXUS Marine Corps) is of the same construction as the M821 cartridge in every detail except the fuze, which is the M935.

c. The M374A3 HE cartridge is constructed from pearlitic malleable cast iron and contains about 2.10 pounds of composition B explosive. It uses the M205 propelling charge, consisting of four horseshoe-shaped increments fitted around the tail. The cartridge is painted olive drab with yellow markings and weighs about 9.05 pounds. It can be fitted with either the M567, M524, or M532-series fuzes.

d. The M374A2, M374A1, and M374 HE cartridges are painted olive drab with yellow markings and are constructed from pearlitic malleable cast iron. They contain about 2.10 pounds of composition B explosive. The M374 cartridge is fitted with the M90 propelling charge. The M374A2 and M374A1 cartridges are fitted with the M90A1 propelling charge. Both the M90 and M90A1 propellants are in nine wax-tested, cotton cloth, bag increments assembled to the tail unit. The cartridge can be fitted with the M524-series, M526-series, M567, or M532 fuzes. Those cartridges assembled with the M524 (A1, A2, A3, or A4) fuze are for use by the US Marine Corps and US Navy only. Cartridges assembled with the M532 fuze must be fired above charge 0. Short cartridges can be expected when firing below charge 4. The cartridge weighs about 9.12 pounds.

e. The M362A1 and M362 HE cartridges are of steel forge construction and contain about 2.10 pounds of composition B explosive. They use the M5 propelling charge that consists of eight cloth bags attached to the tail unit. The cartridges are painted olive drab with yellow markings. They are fuze with the M524-series, M256-series, or M532. Cartridges assembled with the M524 (A1, A2, A3, or A4) fuze are for use by the U.S. Marine Corps and U.S. Navy only. Cartridges assembled with the M532 fuze must be fired above charge 0. The cartridge weighs about 9.4 pounds.

4-19. RED/WHITE PHOSPHORUS AMMUNITION

Several types of RP/WP ammunition are described herein.

a. The M819 cartridge (M252 only) has a cylindrical body and contains red phosphorus that produces white smoke on contact with air. The cartridge uses the M218 propelling charge, which consists of four horseshoe-shaped increments fitted around the tail. The cartridge is painted light green with black markings and one narrow brown band. It uses the M772 mechanical time fuze and weighs about 10.6 pounds.

Note: Red phosphorus rounds can be fired from the M29/M29A1 at a reduced charge (maximum charge = charge 2). This round may be stored in a horizontal position.

b. The M375A3 cartridge is ballistically similar to the M374A3 (HE) cartridge. It contains white phosphorus that produces white smoke on contact with air. The cartridge is painted light green and has red markings and one narrow yellow band. The cartridge uses the M205 propelling charge and is assembled with the M567 or M524-series fuze. It weighs about 9.05 pounds. This round must be stored in a vertical position.

c. The M375A2, M375A1, and M375 cartridges may also be used. They are painted light green with red markings and one narrow yellow band. They are assembled with either an M524-series, M526-series, or M567 fuze. The M375 cartridge uses the M90 propelling charge while the M375A2 and M375A1 cartridges use the M90A1 propelling charge. Cartridges assembled with the M524 (A1, A2, A3, or A4) fuze are for use by the US Marine Corps and US Navy only. Short cartridges can be expected when firing below charge 4. This cartridge is ballistically matched to the M374A2, M374A1, and M375 HE cartridges, and weighs about 9.12 pounds.

4-20. ILLUMINATING AMMUNITION

The M853 and M301A3 illuminating ammunition are described herein.

a. The M853 cartridge (M252 only) has a cylindrical body that contains an illuminating candle and parachute assembly. It provides illumination for about 60 seconds with 600,000 candlepower illumination. It is assembled with the M772A1 MTSQ. It uses the M219 propelling charge and weighs about 9.1 pounds.

b. The M301A3 cartridge has a cylindrical body that contains an illuminating candle and parachute assembly. The round has a burst height of 600 meters and provides illumination for about 60 seconds for an area of about 1,200 meters. It is painted white with black markings. It uses the M185 propelling charge that consists of eight increments fitted into the spaces between the fins and held by a propellant holder. The increments are individually wrapped with waterproof bags that are not removed. The cartridge must not be fired below charge 3.

4-21. TYPES OF FUZES

The types of fuzes described in this paragraph are point detonating, proximity, mechanical time, multioption, and dummy.

a. **Point-Detonating.** All PD fuzes are superquick—detonate on impact.

(1) The M935 fuze has two function settings: impact and delay. It is set using the bladed end of the M18 fuze wrench. It is fitted with a standard pull wire and safety pin that are removed immediately before firing.

(2) The M524-series fuze has two function settings: superquick/impact (SQ/IMP) and delay. When set at delay, the fuze train causes a 0.05-second delay before functioning. When set at SQ, the fuze functions on point impact or graze contact. The fuze contains a delayed arming feature that ensures the fuze remains unarmed and detonator safe for a minimum of 1.25 seconds of flight. It arms within a maximum of 2.50 seconds. To prepare for firing, the slot is aligned in the striker with SQ or delay using the M18 fuze wrench. The safety pull wire is removed just before inserting the cartridge into the mortar.

Note: If, upon removal of the safety wire, a buzzing sound in the fuze is heard, the round should not be used. The round is still safe to handle and transport if the safety wire is reinserted.

WARNING

If the plunger safety pin (upper pin) cannot be reinserted, the fuze may be armed. An armed fuze must not be fired since it will be premature. It should be handled with extreme care, and EOD personnel notified immediately. If it is necessary to handle a round with a suspected armed fuze, personnel must hold the round vertically with the fuze striker assembly up.

(3) The M256-series fuze has an SQ/IMP function only. It is fitted with a safety wire and pin that are removed immediately before firing.

(4) The M567 fuze is an impact fuze that has a SQ/IMP or D function. It comes preset to function on SQ/IMP, and the selector slot should align with the SQ mark on the ogive. To set for delay, the selector slot should be rotated clockwise until it is aligned with the "D" mark on the ogive. An M18 fuze wrench is used to change settings. The fuze has a safety wire that must be removed before firing.

b. **Proximity (VT).** The M532 fuze is a radio doppler fuze that has a proximity (PROX) or SQ/IMP function. An internal clock mechanism provides nine seconds of safe air travel (610 to 2,340 meters along trajectory for charge 0 through 9, respectively). Once set to act as an impact fuze, the mechanism cannot be reset for PROX. The fuze arms and functions normally when fired at any angle of elevation between 0800 and 1406 mils at charges 1 through 9. The fuze is not intended to function at charge 0. However, at temperatures above 32 degrees Fahrenheit and at angles greater than 1068 mils, the flight time is sufficient to permit arming. To convert the fuze from PROX to SQ/IMP, the top of the fuze must be rotated 120 degrees (one-third turn) in either direction. This action breaks an internal sheet pin and internal wire, thereby disabling the proximity function.

c. **Mechanical Time.** These fuzes use a clockwork mechanism to delay functioning for a specific time.

(1) The M772A1 fuze is a MTSQ. It can be set from 3 to 55 seconds at half-second intervals. The settings are obtained from the range tables and are applied using a wrench (number 9239539) or a 1 3/4-turn open-end wrench. The safety wire must be removed before firing.

(2) The M84 fuze is a single-purpose, powder-train, mechanical-time fuze used with the 81-mm M301A1 and M301A2 illuminating cartridges. It has a time setting of up to 25 seconds. The fuze consists of a brass head, body assembly, and expelling charge. The fuze body is graduated from 0 to 25 seconds in 1-second intervals; 5-second intervals are indicated by bosses. The 0-second boss is wider and differs in shape from the other body bosses; the safe setting position is indicated by the letter "S" on the fuze body. The adjustment ring has six raised ribs for use in conjunction with fuze setter, M25, and a setting indicator rib (marked SET) about half the height and width of the other six ribs. Safety before firing is provided by a safety wire, which must be removed just before firing.

(3) The M84A1 fuze is a single-purpose, tungsten-ring, mechanical-time fuze used with the 81-mm M301A3 illumination cartridge. It has a time setting of up to 50 seconds. The

fuze consists of a brass head, body assembly, and expelling charge. The fuze body is graduated from 0 to 50 seconds in 2-second intervals; 10-second intervals are indicated by bosses. The 0-second boss is wider and differs in shape from the other body bosses; the safe setting position is indicated by the letter "S" on the fuze body. The adjustment ring has six raised ribs for use in conjunction with fuze setter, M25, and a setting indicator rib (marked SET) about half the height and width of the other six ribs. Safety before firing is provided by a safety wire, which must be removed just before firing.

d. **Multioption.** The M734 multioption fuze is the only one used with the 81-mm mortar. It has four function settings: PRX (proximity) causes the cartridge to explode between 3 and 13 feet above the ground; NSB (near-surface burst) causes the cartridge to explode up to 3 feet above the ground; IM (impact) causes the cartridge to explode on contact; and DLY (delay) incorporates a 0.05-second delay in the fuze train before exploding the cartridge. No tools are needed to set the fuze, and the setting can be changed several times without damaging the fuze. It has no safety pins or wires to reduce preparation time. If the fuze does not function as set, it automatically functions at the next lower setting.

e. **Dummy.** The M751 fuze is the only dummy fuze used with the 81-mm mortar. It has two types: type 1 resembles the M734 fuze, and type 2 resembles the M935 fuze. The M751 is fitted with a smoke charge that operates on impact. The safety/packing clip should be removed when the cartridge is unpacked.

4-22. CHARACTERISTICS OF PROXIMITY FUZES

A proximity fuze is an electronic device that detonates a projectile by means of radio waves sent out from a small radio set in the nose of the projectile.

a. **Disposal Precautions.** Proximity-fuzed short cartridges, which are duds, contain a complete explosive train and impact element. They should not be approached for 5 minutes or disturbed for at least 30 minutes after firing. After the 30-minute waiting period, the dud is still dangerous but can be approached and removed carefully or destroyed in place by qualified disposal personnel. If the situation allows for a longer waiting period, the dud can be considered safe for handling after 40 hours.

b. **Burst Height.** The principal factors affecting height of burst are the angle of approach to the target and the reflectivity of the target terrain. The air burst over average types of soil ranges from 1 to 6 meters, depending on the angle of approach. High angles of approach (near vertical) give the lowest burst heights. Light tree foliage and light vegetation affect the height of burst only slightly, but dense tree foliage and dense vegetation increase the height of burst. Target terrain, such as ice and dry sand, gives lowest burst heights, whereas water and wet ground give highest burst heights.

c. **Crest Clearance.** Close approach to crests, trees, towers, large buildings, parked aircraft, mechanized equipment, and similar irregularities causes functioning at heights greater than average level. When targets are beyond such irregularities, a clearance of at least 30 meters should be allowed to ensure maximum effect over the target area.

d. **Climatic Effects.** The fuzes may be used for day or night operations. They function normally in light rain; however, heavy rain, sleet, or snow can cause an increase in the number of early bursts. At extreme temperatures (below -40 degrees Fahrenheit and above 125 degrees Fahrenheit), it is not unusual to experience an increase in malfunctions proportionate to the severity of conditions.

e. **Care, Handling, and Preservation.** Proximity fuzes withstand normal handling without danger of detonation or damage when in their original packing containers or when assembled to projectiles in their packing containers.

WARNING

The explosive elements in primers and fuzes are sensitive to shock and high temperatures. Boxes containing ammunition should not be dropped, thrown, tumbled, or dragged.

f. **Installation.** The fuze should already be fitted to the cartridge. If not, the cartridge is placed on its side, and the closing plug is removed using an M18 fuze wrench. (The handle of the wrench is turned counterclockwise.) The fuze threads and fuze well threads are inspected for damage. The fuze is screwed into the cartridge body, and it is seated and secured using an M18 wrench. There must not be a visible gap between the fuze and cartridge body.

WARNING

Do not use the fuze if the thread(s) is damaged. Do not use the cartridge if the fuze well is damaged or if the explosive is visible on the thread.

4-23. FUZE WRENCH AND FUZE SETTER

The fuze wrench, M18, assembles the fuze to the cartridge, and the bladed tip on the end sets PD-type fuzes. The wrench (P/N 9349539) sets M772 MT and M768 time fuzes. It engages the 1 3/4-inch flats on the setting ring or the fuze head. The fuze setter, M25, sets M84-series time fuzes. Notches in the setter engage ribs in the setting ring of the fuze.

4-24. PREPARATION OF AMMUNITION

The propellant train (except the training cartridge) consists of an ignition cartridge and propellant charges. The ignition cartridge has a percussion primer and is assembled to the end of the fin assembly. The propelling charge is contained in four horseshoe-shaped, felt-fiber containers or nine wax-tested, cotton cloth, bag increments. The propelling charges are assembled around the fin assembly shaft.

a. Cartridges are shipped with a complete propelling charge, an ignition cartridge, and primer. Firing tables are used to determine the correct charge for firing. Remaining increments are repositioned towards the rear of the tail fin assembly when firing the cartridge with horseshoe-shaped increments at less than full charge.

Note: Charge 0—Ignition cartridge only.
Charge 1—Ignition cartridge and one increment.
Charge 2—Ignition cartridge and two increments.
Charge 9—Ignition cartridge and nine increments.

b. Increments removed from cartridges before firing should be placed in a metal or wooden container located outside the firing vehicle/position at least 25 meters away. Excess increments should not accumulate near the mortar positions but are removed to a designated place of burning and destroyed. Check the post SOP before applying the following procedure:

(1) Select a place at least 100 meters from the mortar position, parked vehicles, and ammunition piles.

(2) Burn all dead grass or brush within 30 meters around the burning place. Do not burn increments in piles but spread them in a train 1 to 2 inches deep, 4 to 6 inches wide, and as long as necessary.

(3) From this train, extend a starting train that will burn against the wind of single increments laid end to end. End this starting train with not less than 1 meter of inert material (dry grass, leaves, or newspapers).

(4) Ignite the inert material.

(5) Do not leave unused increments unburned in combat operational areas. The enemy will use them.

4-25. CARE AND HANDLING

Ammunition is made and packed to withstand all conditions ordinarily encountered in the field. However, since explosives are affected by moisture and high temperature, they must be protected.

a. Before-firing checks include the following:

(1) Ammunition should be free of moisture, rust, and dirt.

(2) The fin and fuze assembly must be checked for tightness and damage.

(3) Charges must be kept dry.

(4) Extra increments are removed if the cartridge is to be fired with less than full charge.

(5) With the exception of a few unused increments (within the same ammunition lot number) as replacements for defective increments, excess powder should be removed from the mortar position.

(6) The primer cartridge is checked for damage or dampness.

(7) When opening an ammunition box, the ammunition bearer ensures the box is horizontal to the ground, not nose- or fin-end up. After the bands are broken and the box opened, the rounds should be removed by allowing them to roll out along the lid of the box (Figure 4-8). After the rounds have been removed, they should always be handled with two hands to prevent accidental dropping. Dropping may cause the propellant charges to ignite, causing bodily injuries.

WARNING

Incidents occurring from mishandling 300-series ammunition have resulted in minor burns to the hands and legs.

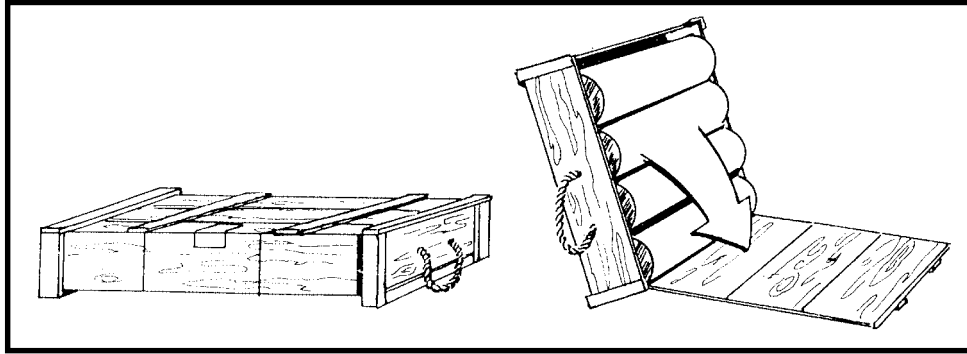


Figure 4-8. Correct way to open an ammunition box.

Note: The floating firing pin located within the primer has approximately 1/16 of an inch to move around. This may cause the firing pin to ignite the charges if the cartridge is dropped on the fin end (Figure 4-9).

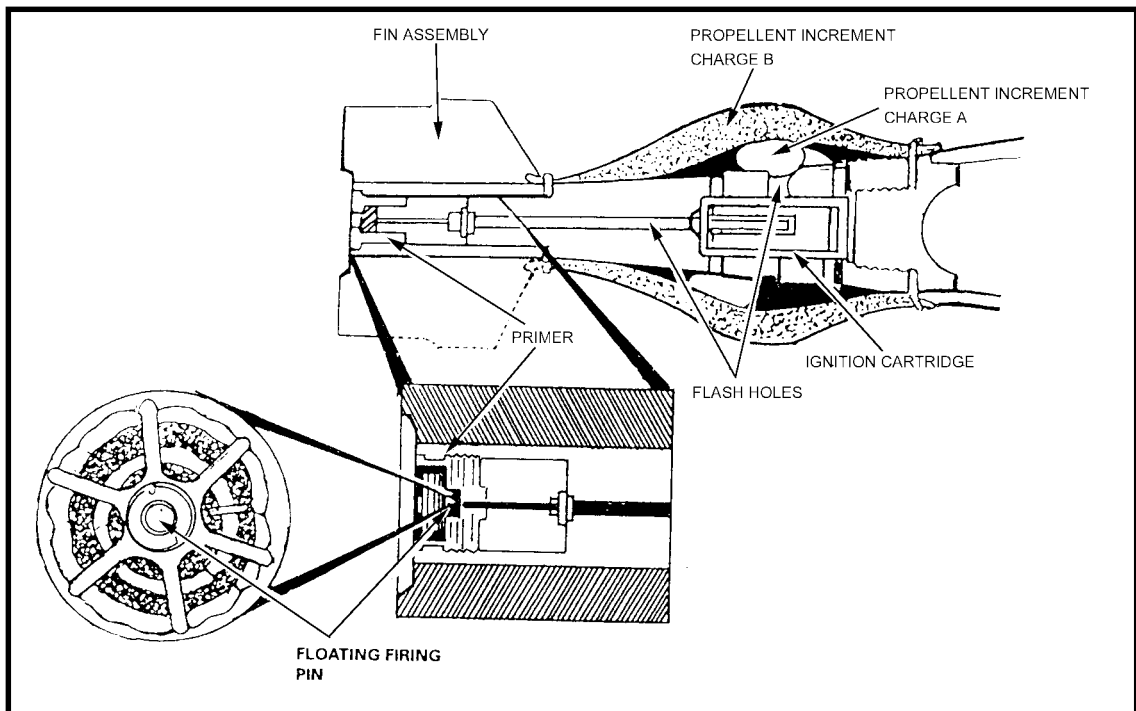


Figure 4-9. Floating firing pin.

(8) To help minimize the occurrence of short rounds and or duds, unpackaged ammunition that has been dropped should not be fired. It should be destroyed in accordance with standard procedures.

DANGER

M800-SERIES CARTRIDGES (HE, TP, SMOKE, AND ILLUMINATION) ARE AUTHORIZED FOR FIRING IN THE 81-mm, M29-SERIES MORTARS ONLY AT CHARGE 3 OR BELOW. FIRING THE M800-SERIES CARTRIDGES ABOVE CHARGE 3 CAN CAUSE CATASTROPHIC FAILURE OF THE MORTAR TUBE RESULTING IN PERSONNEL INJURY OR DEATH.

b. Complete cartridges are always handled with care. The explosive elements in primers and fuzes are sensitive to shock and high temperature. Fuzes are not disassembled.

c. The moisture-resistant seal of the container is broken when the ammunition is to be used. When a large number of cartridges are needed for a mission, they may be removed from the containers and prepared. Propelling charges are covered or protected from dampness or heat.

d. The ammunition is protected from mud, sand, dirt, and water. If it gets wet or dirty, it must be wiped off at once. The powder increments, mainly, should not be exposed to direct sunlight. More uniform firing is obtained if ammunition is kept at the same temperature.

e. The pull wire and safety wire are removed from the fuze just before firing. When cartridges have been prepared for firing, but are not used, all powder increments and safety wires are replaced. The cartridges are returned to their original containers. These cartridges are used first in subsequent firing so that once-opened stocks can be kept to a minimum.

WARNING

Do not handle duds; the fuzes could be armed. Duds are extremely dangerous. Do not move or turn them. To dispose of duds, immediately call the nearest EOD unit.

f. Ammunition should be stored under cover. If it is necessary to leave the ammunition uncovered, it should be raised on dunnage at least 6 inches above the ground. The pile is covered with a double thickness of tarpaulin. Trenches are dug to prevent water from flowing under the pile. WP cartridges are stored with the fuze end up. Since phosphorus liquefies at about 100 degrees Fahrenheit, the ammunition is protected against an uneven rehardening of the filler. An air cavity can form on one side of a cartridge to unbalance it, causing instability in flight. Red phosphorus cartridges (M252 only) are stored the same as HE cartridges.

WARNING

When firing HE ammunition less than 400 meters, personnel must have adequate cover for protection from fragments.

DANGER

M800-SERIES AMMUNITION IS NOT AUTHORIZED FOR FIRING IN THE 81-mm MORTAR, M1.